

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1.-27. (Canceled).

28. (New) A gas concentration detecting apparatus comprising:

a gas sensor comprising:

a first cell for detecting a concentration of oxygen in a measurement gas, the first cell having a first chamber and a pair of first electrodes, discharging or pumping in oxygen contained in the measurement gas introduced from an external space into the first chamber to generate a pumped measurement gas which contains an excessive oxygen and to output a first electric current indicating the concentration of oxygen in the measurement gas when a first electric voltage is applied between the pair of the first electrodes;

a second cell for detecting a concentration of a specific gas in the pumped measurement gas, the second cell having a second chamber and a pair of second electrodes and decomposing the specific gas contained in the pumped measurement gas which is generated by the first cell and is introduced from the first chamber into the second chamber to output a second electric current indicating a concentration of the specific gas in the measurement gas when a second electric voltage is applied between the pair of the second electrodes; and

a heater that heats up at least one of the first cell and the second cell to activate the one of the first cell and the second cell when an electric power is supplied to the heater; and

a controller that determines a completion of activation of the first cell for allowing to start making use of the first signal at a first time moment at which a first predetermined period of time elapses after the electric power has been started to be supplied to the heater to activate at least the one of the first cell and the second cell, and determines a completion of activation of the second cell for allowing to start making use of the second signal at a second time moment which is different from the first time moment, so that the first electric current indicating the concentration of oxygen in the measurement gas is ensured to be used before activation of the second cell is completed.

29. (New) The gas concentration detecting apparatus according to claim 28, wherein the controller determines the second time moment at which the controller determines that the activation of the second cell is completed when a second predetermined period of time elapses after the activation of the first cell has been completed.

30. (New) A gas concentration detecting apparatus comprising:

a gas sensor further comprising:

a first cell for detecting a concentration of oxygen in a measurement gas, the first cell having a first chamber and a pair of first electrodes, discharging or pumping in oxygen contained in the measurement gas introduced from an external space into the first chamber to generate a pumped measurement gas which

contains an excessive oxygen and to output a first electric current indicating the concentration of oxygen in the measurement gas when a first electric voltage is applied between the pair of the first electrodes; and

a second cell for detecting a concentration of a specific gas in the pumped measurement gas, the second cell having a second chamber and a pair of second electrodes and decomposing the specific gas contained in the pumped measurement gas which is generated by the first cell and is introduced from the first chamber into the second chamber to output a second electric current indicating a concentration of the specific gas in the measurement gas when a second electric voltage is applied between the pair of the second electrodes; and

a controller that determines a completion of activation of the first cell for allowing to start making use of the first signal at a first time moment at which a first predetermined period of time elapses after the electric power has been started to be supplied to the first and the second cells to activate at least the one of the first cell and the second cell, and determines a completion of activation of the second cell for allowing to start making use of the second electric current when a predetermined time elapses after the second electric current flowing in the second cell of the gas sensor is fallen into a predetermined range.

31. (New) A gas concentration detecting apparatus comprising:

a gas sensor further comprising:

a first cell for detecting a concentration of oxygen in a measurement gas, the first cell having a first chamber and a pair of first electrodes, discharging or pumping in oxygen contained in the measurement gas introduced from an external

space into the first chamber to generate a pumped measurement gas which contains an excessive oxygen and to output a first electric current indicating the concentration of oxygen in the measurement gas when a first electric voltage is applied between the pair of the first electrodes;

a second cell for detecting a concentration of a specific gas in the pumped measurement gas, the second cell having a second chamber and a pair of second electrodes and decomposing the specific gas contained in the pumped measurement gas which is generated by the first cell and is introduced from the first chamber into the second chamber to output a second electric current indicating a concentration of the specific gas in the measurement gas when a second electric voltage is applied between the pair of the second electrodes; and

a third cell for detecting a residual oxygen concentration of said measuring gas after passing through said first cell, the third cell outputting a third electric current indicating the residual oxygen concentration in the measurement gas when a third electric voltage is applied thereto; and

a controller that determines a completion of activation of the first cell for allowing to start making use of the first signal at a first time moment at which a first predetermined period of time elapses after the electric power has been started to be supplied to at least the first and the second cells to activate at least the one of the first cell and the second cell, and determines a completion of activation of the second cell for allowing to start making use of the second electric current when a predetermined time elapses after the third electric current flowing in the third cell of the gas sensor is fallen into a predetermined range.

32. (New) The gas concentration detecting apparatus according to claim 29, wherein the second predetermined period of time is determined on the basis of a time needed for discharging all oxygen absorbed onto one of the second electrodes of said second cell.

33. (New) The gas concentration detecting apparatus according to claim 30, wherein the first cell comprises a first solid electrolyte element which is sandwiched between the first electrodes, and the second cell comprises a second solid electrolyte element which is sandwiched between the second electrodes, further comprising:

an element resistance monitor for monitoring a resistance value of at least one of the first and second solid electrolyte element to control a degree of activation of the cell in order to keep the resistance value of the corresponding solid electrolyte element at a first predetermined target value after starting energization of the gas concentration sensor,

wherein the controller determines the completion of the activation of the first cell for allowing to start making use of the first signal when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor becomes a second predetermined target value.

34. (New) The gas concentration detecting apparatus according to claim 31, wherein the first cell comprises a first solid electrolyte element which is sandwiched between the first electrodes, the second cell comprises a second solid electrolyte element which is sandwiched between the second electrodes, and third cell comprises a third solid electrolyte element, further comprising:

an element resistance monitor for monitoring a resistance value of at least one of the first, second, and third solid electrolyte element to control a degree of activation of the cell in order to keep the resistance value of the corresponding solid electrolyte element at a first predetermined target value after starting energization of the gas concentration sensor,

wherein the controller determines the completion of the activation of the first cell for allowing to start making use of the first signal when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor becomes a second predetermined target value.

35. (New) The gas concentration detecting apparatus according to claim 33, wherein the controller determines a completion of activation of the first cell for allowing to start making use of the first signal, when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor is within a predetermined range, and a predetermined time elapses after the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor has been within the predetermined range.

36. (New) The gas concentration detecting apparatus according to claim 34, wherein the controller determines a completion of activation of the first cell for allowing to start making use of the first signal, when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor is within a predetermined resistance range, and a predetermined time elapses after the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor has been within the predetermined range.

37. (New) The gas concentration detecting apparatus according to claim 33, wherein the controller determines a completion of activation of the first cell for allowing to start making use of the first signal, when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor becomes a second predetermined target value, and a predetermined time elapses after the monitored resistance value of the first solid electrolyte element which is monitored by the element resistance monitor has become the second predetermined target value.

38. (New) The gas concentration detecting apparatus according to claim 34, wherein the controller determines a completion of activation of the first cell for allowing to start making use of the first signal, when the monitored resistance value of the solid electrolyte element which is monitored by the element resistance monitor becomes a second predetermined target value, and a predetermined time elapses after the monitored resistance value of the first solid electrolyte element which is monitored by the element resistance monitor has become the second predetermined target value.

39. (New) The gas concentration detecting apparatus according to claim 30, further comprising:

a heater that heats up at least one of the first cell and the second cell to activate the one of the first cell and the second cell when an electric power is supplied to the heater, and wherein the controller that determines the completion of activation of the first cell for allowing to start making use of the first signal at a first time moment at which a predetermined period of

time elapses after the electric power has been started to be supplied to the heater to activate at least the one of the first cell and the second cell.

40. (New) The gas concentration detecting apparatus according to claim 31, further comprising:

a heater that heats up at least one of the first cell and the second cell to activate the one of the one of the first, second, and third cell when an electric power is supplied to the heater, and wherein the controller that determines the completion of activation of the first cell for allowing to start making use of the first signal at a first time moment at which a predetermined period of time elapses after the electric power has been started to be supplied to the heater to activate at least the one of the first, second, and third cell.

41. (New) The gas concentration detecting apparatus according to claim 30,

wherein the predetermined period of time is determined on the basis of a time needed for discharging all oxygen absorbed onto one of the second electrodes of said second cell.

42. (New) The apparatus according to claim 28, wherein

the first electrodes of the first cell is reactively inactive with respect to the specific gas,
and

the second electrodes of the second cell is reactively active with respect to the specific gas.

43. (New) The apparatus according to claim 28, further comprising:

a third cell for detecting a residual oxygen concentration of said measuring gas after passing through said first cell,

wherein an amplitude of said first voltage to be applied to said first cell from the power supply is variably controlled on the basis of a detection result in said third cell.